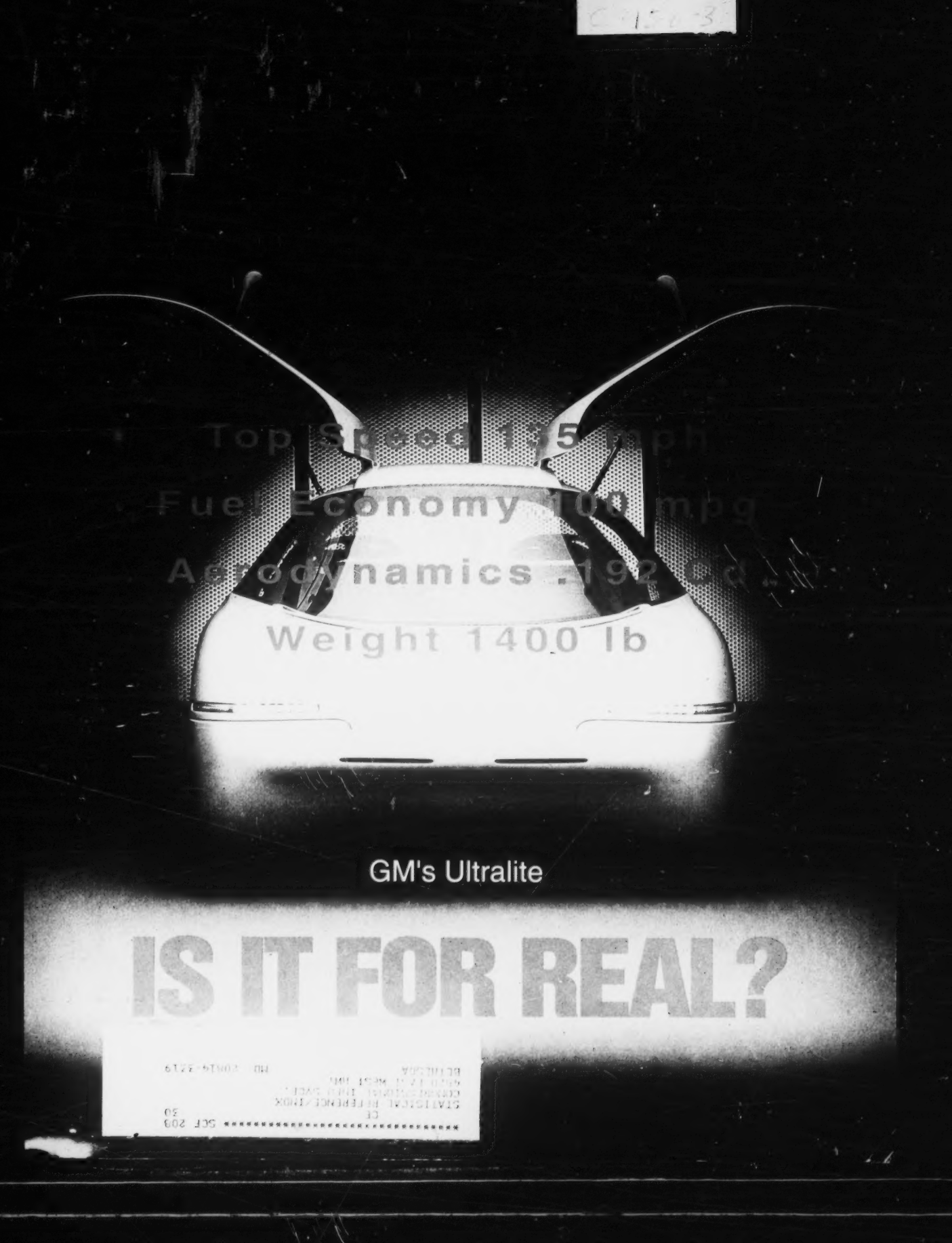
Top Speed 175 mph
Fuel Economy 100 mpg
Aerodynamics .192 c d
Weight 1400 lb
GM's Ultralite
IS IT FOR REAL?

Volume 172, No. 3 March 1992

GM's 100 mpg Ultralite is a rolling high-tech classroom with lots of lessons inside. Cover Photography: General Motors

CHILTON'S
AUTOMOTIVE INDUSTRIES

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Europe's Changing Market

Unified Germany key to 1991 sales increase.

The good news is that new car demand in Europe for MY91 was a record for the seventh successive year. At over 13.51 million units sold, the total was fractionally higher than the previous year. The bad news was that Europe's bottom line was almost entirely sustained by Germany, the region's largest national market. Potential customers in the rest of Europe stayed home in their droves.

The consumer boom created by the collapse of communism, and subsequent German unification, contributed an additional 917,000 sales last year. Germany finished the year with nearly 4.2 million vehicle sales, roughly half again as many as 1989 figures.

But consumer confidence in the rest of Europe failed to match that of Germany. Concerns about national economies, high interest rates and increasing unemployment resulted in the next four largest markets—Italy, France, Britain, and Spain—dropping 825,000 units between them.

Automakers make more than 80% of their European new car sales in these five markets. They therefore set the overall European pattern, whatever the boom (Greece) or bust (Finland) elsewhere.

Unquestionably, the downfall of communism underpinned last year's auto industry performance. It provided an unexpected boost in what would have been a grim year. Even so, layoffs and job cuts were common across much of Europe. But Germany's unification spree was a one-off, unlikely to be repeated. Automakers are developing sales forces in other former communist countries, but progress will be slower and more painful.

The German experience helps explain why the Volkswagen Group, Ford of Europe and General Motors-Europe—all with strong German bases—recorded record sales. It also explains why VW strengthened its position as Europe's leading automaker, while that of second-place Fiat weakened Not that other automakers were left out by German car-lust. The French, Italian and Spanish—faced with sluggish domestic demand—were quick to spot the opportunity. Starting from relatively small bases, their share gains were impressive.

EUROPE'S WINNERS AND LOSERS

Manufacturer	1991	1990
Volkswagen Group		
Fiat Auto		
Japan (all)		
General Motors		
Peugeot SA		
Ford		
Renault		
Mercedes-Benz		
BMW		
Rover		
Others		
Volvo		
Total		

Another clear trend was the increasing fluidity of national market shares. The pattern is likely to accelerate as traditional borders are dismantled under the terms of the single European market, which becomes reality in '92. Some examples:

Renault and Peugeot of France and Spain's Seat did well in Germany last year, while all German-based groups except Ford slipped back, unable to meet demand. At the same time, Renault lost additional share in France, while Ford and GM's Opel made advances. In Italy, where Fiat lost a large chunk of the market, the gainers were importers like Ford, Renault and Opel. Peugeot improved in Britain, while Ford and GM's Vauxhall fell back. The other notable advance was made by the Japanese group, whose 12.3% (nearly 1.67 million units) included share gains in every national market except two: Germany, where Japan was not as nimble as the locals at exploiting the boom, and in Britain, where the leading maker, Nissan, was involved in an acrimonious legal dispute with the privately owned importer.

Nissan was again Europe's top Japanese make, as it has been for a couple of decades. It ended the year with 439,000 sales to Toyota's 361,000 and Mazda's 287,000. Honda was a distant fifth behind Mitsubishi.

The Nissan advantage over Toyota stems from its early inroads in Europe, particularly in Britain. The subsequent quotas imposed on Japanese cars then prevented other companies from catching up. Nissan's early groundwork prompted it to become the Japanese transplant pioneer in Europe. Now, with Japan's undertaking to continue European sales restraints for the rest of the century, Nissan looks set to hang on to its lead. It has laid down capacity to build 300,000 cars a year in Britain by 1993, while Toyota's and Honda's 100,000-unit transplants come on stream only at the end of this year. AI

by LINDSAY BROOKE

FUELS' PARADE

Alternative-fueled vehicles will soon hit the streets in volume. But many developmental problems still nag engineers.

What will eventually replace gasoline as America's dominant motor fuel? As legislators nationwide trip over themselves to adopt California's stringent exhaust emissions laws, industry testing of potentially cleaner 'alternative' fuels proceeds in parallel with advanced emissions systems development. So far, a leading candidate to supplant 'good old gas' has yet to emerge—and one may not.

"Instead of having one fuel that replaces gasoline, there'll be a mix of fuels," predicts Scott Levy, vp of technical affairs at Clean Vehicle Technologies Co. (CVT), an independent alt-fuels and emissions program management firm based in Chicago. "Up until the 1996 model year, we're going to see a variety of fuels running in very low volumes of demonstration vehicles. At that point, it'll really open up."

Along with other emissions experts, Levy believes most automakers will then be selling two or three models of flexible fuel vehicles (FFV), designed to run on mixtures of methanol or ethanol alcohol and gasoline, at increased (over 100,000 unit) production levels. He says that by the late '90s, compressed natural gas (CNG)-fueled vehicles will have emerged in similar volume.

Shortly after the year 2000, advances in battery and accessory technology may begin to make electric vehicles truly viable. Within that timeframe, the Motor Vehicle Manufacturers Association estimates that 25% of all US vehicle travel will be by FFVs. Ultimately, Levy says hydrogen may come into its own as a motor fuel, but not until roughly year 2025.

Behind the move to FFVs and alt-fueled vehicles in general are the Alternative Motor Fuels Act of 1988, which provides automakers with incentives (CAFE credits) to produce alt-fueled cars and trucks, beginning in 1993, and the Clean Fuel Fleet Program. AMFA requires the demonstration and testing of alternative fuels in a variety of vehicles. It encourages federal agencies (including the Department of Energy, General Services Administration, Department of Transportation and the EPA) to purchase, with incentives, these vehicles for testing and use in their fleets.

The Clean Fuels Fleet program established by the Clean Air Act of 1990 covers fleets of 10 or more vehicles that are, or are capable of, central fueling. The program begins in 1998 in the 22 smoggiest US metropolitan areas, unless cars meeting these standards are not being sold in California—then it begins in 2001. It mandates that 30% of new fleet purchases, phasing up to 70% and including some large truck fleets, must meet California low-emission vehicle (LEV) standards (see chart on p.28).

Currently, Chrysler, Ford, GM and to a lesser extent, the imports, are testing the following fuels in thousands of mainly fleet cars and trucks in the United States: the alcohol/gasoline blends M85 and E85 (containing 85% methanol or ethanol with 15% gasoline blended in to aid cold starting); CNG; liquified petroleum gas (LPG); reformulated gasolines and diesel.

Hydrogen power has not been explored as deeply by American automakers as it has by some German companies and by Mazda.

While much progress has been made with 'alt fuels,' many problems still nag engineers developing alt-fueled vehicles. Depending on which California emission law they're applied to, most alt fuels cause degrees of driveability and/or emissions glitches. And most of them require new, often costly emissions systems hardware for optimum operating performance.

Says Gary McCarbery, GM Powertrain's technical manager, alternative fuels, "Unfortunately, none of these fuels contain a magic 'silver bullet' that we know of."

Nevertheless, alt-fuel technologists are trying to keep pace with a firestorm of political and environmental mandates. As this is written, Massachusetts has voted to adopt the California standards along with 14 other states. To help keep you abreast of developments, *AI* presents the following alt-fuel update, based on interviews with powertrain engineers, emissions experts, and related EPA and independent data. [Please note that while electric vehicles are generally considered to be alt-fuel, we covered them in a separate feature last month.]

Flexible Fuel Vehicles: Known as FFVs at Chrysler and Ford and VFVs (variable fuel vehicles) at GM, they can run on M85, gasoline, or any combination of the two. MVMA president Thomas Hanna says FFVs are especially important in a transition from gasoline-powered vehicles, because consumers will be more likely to consider new alt-fuel technologies if they know they can refuel with conventional gasoline when the M85 is not available. Hanna stresses that FFVs allow more time to develop the US refueling infrastructure. They also encourage fleet owners to use M85, as FFVs will be easier to sell once they exceed fleet mileage limits.

Chrysler will build 4500 methanol-flexible 1993 Plymouth Acclaim and Dodge Spirit models, 2000 for California fleet and retail sales and 2500 for the GSA, which is spending $31.5 million in fiscal 1992 to buy 3125 alt-fuel vehicles from Chrysler and GM. Chrysler is offering $2000 rebates on FFVs to fleet buyers.

According to Francois Castaing, vp of vehicle engineering, Chrysler is planning for production of up to 100,000 FFVs in 1994 and 1995.

Ford will build 2800 flex-fuel Tauruses later this year, mostly for California, according to Harvey Klein, manager of alternative fuels engineering planning for North American operations. The cars will provide further durability data in various climatic conditions.

CALIFORNIA 'CLEAN CAR' PILOT PROGRAM

	Year begins	No. of cars, light trucks	Tailpipe Standards NMHC	CO	NOx
Phase I	1996	150,000	0.125	3.4	0.4
Phase II	2001	300,000+	0.075	3.4	0.2

Notes: ❑ California must adopt program to assure fuel availability; if it doesn't, EPA must. ❑ California can adopt its own vehicle control program instead of the pilot program. ❑ Other states may opt-in to the program. Source: EPA

Klein says Ford plans Taurus FFV volume production in the 1994 timeframe but he's unsure of what 'volume' will be, adding that there are currently over 100 incentive programs for fleet purchasing among the states and federal government. A year ago there were 44 programs.

GM built 20 VFV Corsicas in 1989, all for California. In 1991 it built 200 variable-fuel 3.1 L Luminas, all-set up for M85. "For 1992, we've offered to California and the rest of the US capability to build 4000 more," says Gary McCarbery. Among the imports, most of the Japanese companies, Volvo, VW and Mercedes-Benz are all running small FFV test fleets in the US.

Fuel sensors are key to FFVs. Chrysler's is detailed on page 52 of this issue. GM's was developed by the Powertrain division and AC Rochester. Both measure the capacitance of the fuel, determining the percentage of alcohol in vehicle. The GM sensor includes a read-out on the dashboard which counts down the methanol/gasoline percentages as the car runs low on fuel.

"The only reason you'll see FFVs sell in big numbers is to get CAFE credits," states CVT's Levy. "The manufacturers will make them to run well on gasoline and OK on methanol—and they figure most people are not going to put methanol in them anyway."

M85 and E85: Automakers are reluctant to get a straight M85 program going for the end of the decade because they want to see how the FFVs will sell. GM, for example, has no dedicated M85 vehicles planned for production because "we have a hard enough time selling variable fueled vehicles—people afraid they can't get fuel," says McCarbery.

But if the industry does go to dedicated M85, automakers could realize power and fuel economy increases of 5% to 10%, due to M85's capability to support compression ratios as high as 12:1 or 13:1.

Besides fuel injector size and fuel pump capacity doubling, piston architecture will change, engineers note, with 'dry' fuels such as methanol or CNG. Going to a higher piston height in the combustion chamber bumps up compression.

And moving the head-land area up (decreasing the gap space between the first piston ring and the piston crown) can yield much lower HC emissions. This can also be done with gasoline, but it's not as effective.

For dedicated alcohol-powered engines, M85 is currently the leading candidate, mainly due to economics. Taking into account that methanol's energy density is 45% lower than gasoline, the cost of methanol is on a gasoline equivalency with premium unleaded, particularly when the gasoline becomes the more expensive reformulated fuel in the next few years.

IMPLEMENTATION SCHEDULE FOR CARB STANDARDS

Model Year	TLEV .125	LEV .075	ULEV .040	ZEV .00	Fleet Avg. Standard
1996	20%				.225
1997		25%	2%		.202
1998		48%	2%	2%	.157
1999		73%	2%	2%	.113
2000		96%	2%	2%	.073
2001		90%	5%	5%	.070
2002		85%	10%	5%	.068
2003		75%	15%	10%	.062

Standards noted above are for NMHC—non-methane hydrocarbons in g/mi. Percentage requirements for ZEVs

California Air Research Board (CARB) is mandating the emissions-free vehicle through a progressively restrictive set of standards. TLEVs are Transitional Low Emissions Vehicles; LEVs are Low Emissions Vehicles and ULEVs are Ultra Low Emissions Vehicles. ZEVs are Zero Emissions Vehicles—technically, electric vehicles and possibly hydrogen-powered vehicles.

Both alcohols are somewhat corrosive and lack the lubricity of gasoline. They require stainless steel fuel tanks and Nylon 11 and 12 lines. Ethanol is slightly less corrosive than methanol. Durability has not been a major problem; between 1984-87, Ford's 27-car test fleet racked up over a million miles with no major fuel-related problems.

"We could go methanol or ethanol, but we want to find out what the ozone improvement factors are," says Ford's Klein. "Right now, we think methanol has a slight advantage. But it's an economic and infrastructure issue, one that the oil and chemical companies will have to work with us on."

This year, GM will supply 49 E85-powered vehicles to Illinois, Wisconsin and the US DOE. GM had orders for more, says McCarbery, but deliberately withheld them, turning down orders from Iowa and Missouri because the response to ethanol just wasn't encouraging compared to methanol.

The infrastructure is the sticking point with both fuels. California now has roughly 20 stations with M85 refueling capability, with near-term plans to grow to 50. But the effort in the other 49 states has hardly begun. The Detroit area has two M85 stations.

Reformulated Gasoline: Refined to eliminate many pollutants, reformulated gasoline doesn't have the problems of performance, range and consumer acceptance of other alt fuels, says the MVMA's Hanna. But Scott Levy of CVT doesn't consider reformulated gasoline to be a true alternative fuel.

"First, at best it can only yield about a 20% reduction in HC, and maybe a 10% reduction in NOx. Second, the more you try to put hardware on the vehicle to get those reductions, the less reductions you get. There's a ceiling there; you can only go so far. But with the other fuels, there are opportunities to squeeze more out as you increase the technology in the vehicle."

Levy and other engineers believe the big gains with reformulated gasoline will come from close-coupled catalysts. And achieving a wide powerband necessitates variable valve timing and improved EGR. The latter, engineers say, is software-driven EGR that's a grade more powerful than Ford's current PCOMP system.

But the biggest emissions improvements on reformulated gasoline-powered vehicles will probably come not from add-on hardware, but from engine design changes. Included here are bottom-feed air-blast fuel injectors, which greatly improves fuel spray atomization. Such injectors are part of many current two-stroke engine programs.

"Now you can start injecting down in the low end, close to valve opening, without clogging up the port with raw fuel, which brings the HC and NOx way down," notes Levy. And variable valve timing will allow injection on an open valve with timing changed so you get high overlap at high rpm and low overlap at low rpm.

CLEAN AIR ACT AMENDMENTS OF 1990

1994:	■ 50% further reduction of exhaust emissions
2004-2006:	■ Represent a 99% reduction in HC from pre-control levels, 98% for CO, 95% for NOx
	■ Require doubled life of emission control equipment
	■ Require on-board diagnostics (OBD) and mandates longer warranties

Another option for companies who do not choose to add the $250-$300 per unit cost of a VVT system, would be to stay with low valve overlap and change the injector timing, injecting closer to an opening valve at low rpm, to make up for some of the overlap, Levy explains.

Engine Controller Changes: Look for more powerful control algorithms to appear in 1993 on GM vehicles and in 1994-95 on Fords. Once engines include a mass airflow sensor, there's a lot more that can be done in terms of software strategies.

But limited compression ratios and combustion efficiencies can limit gains here. So improvements to combustion chamber design and induction

systems (split-port cylinder heads by the mid-'90s) may be needed to match the new controller capabilities, variable valve and injection timing, etc. Again, it's **the old 'no free lunch'** syndrome.

Compressed Natural Gas: CNG allows compression ratios as high as 12:1, for more power, but its big problem is NOx.

CNG has been chosen for light trucks and some large rwd cars be-

ALT-FUEL VEHICLE TECHNOLOGY CAPABILITY SUMMARY FOR LIGHT DUTY VEHICLES

TYPE OF TECHNOLOGY	EXPECTED EMISSIONS CAPABILITY	CURRENT DEVELOP-MENT	CURRENT PERCENT DEVELOP.	MARKET ENTRY EST. YEAR	UNIQUE SYSTEMS HARDWARE ASSOCIATED WITH TECHNOLOGY (1)	FUEL ECON. COMPARED TO BASE (1)	EST. FIXED COST PENAL. (ADVTG) (1)	COMMENTS
Reformulated Gasoline Vehicles (RFGVs)	TLEV	Yes	95%	1994	EEP, MDIS, ICCC, IEGR	Same	$115	Improved cold operations emissions
	LEV	Yes	65%	1996/7	Same as TLEV plus: ABI, IPH, EDI, VVT	(0.3) mpg	$415	Lower engine out emissions, improved catalyst efficiency
	ULEV	Yes	35%	1998/9	Same as LEV plus: EMC, EHC	(0.3-0.5) mpg	$600	50K durability not yet attained for LEV & ULEV
FFVs On Blends Of M85 or E85 and Gasoline	TLEV	Yes	85%	1994/5	Same as TLEV RFGV plus: UFSM, CSS, EDI, ACS	(9-12) mpg	$630	Fuel operating cost penalty of $0.30/gal, 30% decline in NMOG
	LEV	Yes	60%	1997/8 [3]	Same as TLEV FFV plus: ICL, engine design optimization	(6-10) mpg	$680	Optimized for M85/E85 operation, another 10% decline in NMOG
Dedicated M85 or E85 Vehicles	LEV	Yes	65%	1997/8 [3]	Same as TLEV FFV plus: ICL, engine design opt. eliminate ASC	(6-10) mpg	$590	Emissions durability better than FPV. Lower FFV. Fleet compst emission
	ULEV	No	0%	2003 [3]	Same as DM85/E85 LEV plus: VVT, ABI	N/A	$760	50K durability not yet attained for LEV/ULEV DM85/DE85/FEV
Dedicated CNG Vehicles	LEV	Yes	35%	1995/6	EDO, HPVS, CLFC, MCS, IGER, high-pressure fuel delivery system	+5 mpg	$1690	Fuel operating cost less compared to gasoline. 50K LEV/ULEV not attained.
	ULEV	Yes	10%	1998/9	Same as LEV CNG plus: ICL, LHPVS, VVT, ICCC, FCC	+7 mpg	$1390	Low-cost/light-weight fuel storage allows for higher sales volume
Dedicated LPG Vehicles	TLEV	Yes (truck)	75%	1995/6	CLFC, HPFT, IEGR, ICL, EDO, medium-pressure fuel delivery system	+2 mpg	$(75)	Poor cold ambient temp. engine warm-up
	LEV	No	0%	N/A	Same as TLEV LPG plus: EEP, MDIS, ICL, VVT, improved CLFC	N/A	$385	LEV emissions levels not yet attained
	ULEV	No	0%	N/A	N/A	N/A	N/A	Currently not considered feasible with known technology
Clean Diesel Vehicle	TLEV	Yes	55%	1994/5	IDI Diesel engine with EFI, IEGR, PT, and exhaust catalyst	+8 to 10 mpg	$660	Emissions durability better than FFV. Lower FFV. Fleet Compst. emission
	LEV	Yes	30%	1996/7	DI Diesel engine, EFI, VVT, IEGR, PT, LCIE & exhaust catalyst	+8 to 10 mpg	$1235	Fuel infrastructure in place, fuel oprtns. costs less than gasoline
Hydrogen Combustion Vehicle	ULEV	Yes	5%	2005/10	Hydrogen burn IC engine. High pressure fuel storage and fuel delivery system	(-15-20) mpg	N/A	Mainly being persued in Europe. Main emission is H_2O. Fuel costs, safety and system currently extremely cost-prohibitive
	ZEV	?	?	2010?	N/A	?	N/A	

Abbreviation of Definitions

ABI	Air Blast Fuel Injectors	EHC	Electrically Heated Catalyst	IPH	Intake Port Electric Heater
ASC	Alcohol Composition Sensor	EMC	Engine Mounted Catalysts	LCIE	Low Friction/Compression Ignition Engine
CCS	Cold Start System	FCC	Fuel Composition Compensation	LHPVS	Light Weight HPVS
CLFC	Closed Loop Accurate Fuel Control	HPFT	High Pressure Fuel Tank	MCS	Methane Catalyst System
DI	Direct Injection Diesel	HPVS	High Pressure Vessel Storage	MDIS	Multifire Distributorless Ignition
EDI	Engine Design Improvements	ICCC	Improved Close Coupled Catalyst	PT	Particulate Traps
EDO	Engine Design Optimization	ICL	Increased Catalyst Loading	UFSM	Upgraded Fuel System Materials
EEP	Enhanced Engine Processor	IEGR	Improved EGR	VVT	Variable Valve Timing
EFI	Electronic Fuel Injection	IDI	Indirect Injection Diesel		

Source: Clean Vehicle Technologies Co.

Footnotes:

(1) Base is 3500 lb. passenger vehicle operating on gasoline and certified to 1993 California emissions standard.

(2) Based on M85 due to lower energy content compared to gasoline.

(3) Vehicles will be only marketed in these years if testing and technology development allows.

cause only these vehicles can handle lugging around two or three heavy (300-400 lb. each) fuel cylinders. And the compressed gas, which has a density similar to diesel fuel, adds 25% more weight. In a car, this means taking a big chunk of the trunk out just to fit the cylinders.

Powertrain engineers say supplier development of lightweight, possibly composite cylinders that will pass DOT fuel tank standards is needed to push CNG into smaller passenger car platforms. Mass production is also needed to lower cost, because gas cylinder manufacturing now is a very low volume, high cost venture.

"If the industry wants to sell a couple million CNG vehicles a year, instead of a couple hundred thousand, it can't do it with today's fuel cylinders," says Levy.

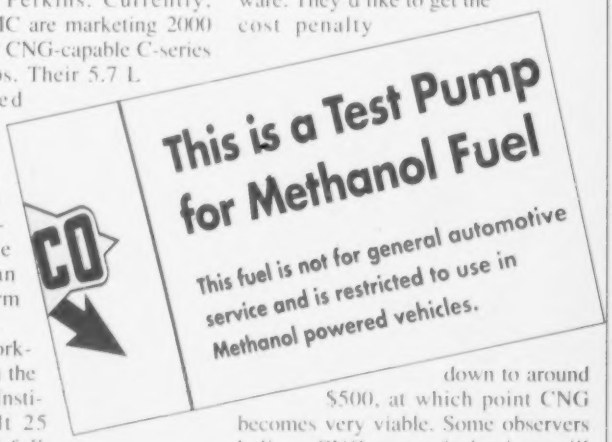
Ford will have 30-50 CNG Crown Victorias in test this year, says Klein, primarily in gas utility fleet duty. Later in '92 will come 50-100 E- and F-series trucks. GM is developing dedicated CNG/LPG truck engines for the mid-'90s, says Chevrolet general manager Jim Perkins. Currently, Chevy and GMC are marketing 2000 fully warranted CNG-capable C-series 3/4-ton pickups. Their 5.7 L V8s are fitted with hardened valves, valve seats and piston rings. Conversions are done by Pas Inc., an aftermarket firm in Pontiac, MI.

Chrysler, working jointly with the Gas Research Institute, has built 25 CNG-powered full-size vans, 20 of which are in fleet use across the US. Production will soon begin on up to 2000 CNG vans for 1992. Chrysler engineers say they're having a difficult time adapting CNG to their minivans and compact trucks, due to space and weight constraints.

How are some of these vehicles faring in the real world? Pretty well, so far. According to a status report given to the Santa Barbara County air pollution control district by the engineering firm Innovative Technologies Group, the eight Ford Tauruses and one Chevy S-10 pickup in use have met TLEV standards of .125 g/mi HC, 3.4 g/mi CO and 0.4 g/mi NOx. The report notes that there have been some occurrences of above-target NOx emissions, which it attributes to quality variations in the gas and low CNG storage cylinder pressure.

Why will CNG become big? The oil companies and utilities like it. They have lots of it. Amoco and Chevron are rapidly developing pressure stations around the country. Southern California Gas has just announced they hope to have 1300 CNG stations by the year 2000 on the west coast. There are currently over 300 commercial and private natural gas refueling stations in the US.

Most CNG development going on is in dedicated vehicles. Automakers are now trying to solve CNG's added costs—about $2600 per vehicle, of which $1500 is fuel tank assemblies and the rest engine changes and hardware. They'd like to get the cost penalty down to around $500, at which point CNG becomes very viable. Some observers believe CNG motor fuel prices will become regulated. Anti-gouging higher CNG prices at motor refueling stations, which would increase the price of the gas for home heating and electric power, the government is already talking about putting ceilings on what the oil companies can charge on the 'rack' price of CNG. And while the CNG refueling infrastructure grows, another question arises. Should CNG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be used in an electric plant to create electricity for electric vehicles, or should it be developed for fueling CNG vehicles?

CNG's biggest problem may be its inconsistent quality. Natural gas grades vary greatly, depending on where it comes from. And it is injected with certain other elements such as propane, to raise its quality and aid cold weather ignition. More propane can hurt emissions.

It is difficult for engineers to calibrate vehicles when the fuel's inconsistent. To a certain extent, they say engine controllers can compensate for this. Other hardware can help: Just like the meter on FFVs which monitors alcohol content, CNG-powered vehicles may have a meter which gauges gas quality.

But should CNG retailers have to screen or cleanse the gas to make it consistent in quality—which will add cost—or should they be allowed to sell any gas right off the pipeline for motor use?

The Natural Gas Coalition has contracted Southwest Research Institute to study how the differences in natural gas effects engine emissions. CNG in general reduces HC by about 66%. But right now, there is no baseline for fuel composition, says CVT's Levy. "If you've got CNG with 95% methane, 5% propane and a little bit

Driving On M85

I had to call Chrysler and check whether the flex-fuel Dodge Spirit I had was running on M85—its operation was that transparent. Except for a slight increase in cold cranking time and a decrease in distance between fuel stops, this Spirit was like any other.

With just two refueling stations presently in the Metro Detroit area, running on straight M85 could pose a problem. But then this is a flex-fuel car, and it will drink unleaded gasoline just as easily—if a bit more slowly. Unfortunately, M85 has half the energy content of gasoline, and costs the same as premium unleaded.

M85 has two advantages. First, a gas station emissions test showed HC emissions of 19 ppm (versus a standard of 220), with CO at 0.02% (versus the 1.20% standard). Second, the Spirit seemed slightly quicker on the methanol fuel.

The average consumer, however, will probably notice little difference—except for the car's changing range as the gasoline percentage rises and falls with methanol availability.

—Christopher A. Sawyer

***Methanol-fueled Dodge Spirit tested by* Automotive Industries.**

of moisture and contaminants, what will the engine's emissions be versus 75% methane, etc?" he asks.

Liquified Petroleum Gas: LPG (propane), like CNG, is restricted in current use by the size and weight of its storage system.

Therefore, its testing and use in on-road vehicles has been limited to trucks. Ford's LPG program has focused on F600 and F700 series medium-duty units. According to Harvey Klein, the company is releasing LPG for volume production on its 7.0 L truck V8 in 1993.

The infrastructure is even more extensive than with CNG, due to LPG's industrial uses. There are now 350,000 propane-fueled vehicles in the US, 300,000 in commercial and fleet use.

Durability Issues: The topic of exhaust emissions is really three topics: the emissions when the vehicle's new, how much that changes over time as the engine and emissions hardware wear, and how much variability there is from test to test and from vehicle to vehicle.

If a standard is say, 0.125 g/mi, as it is with NMHC in TLEV, automakers want to be able to certify at 4000 miles at 0.9 g/mi and still make the standard at 50,000 and 100,000 miles. They don't want to have a big gap between 4000 and 50,000 miles, because then they have to get unbelievably low numbers at 4000.

They want to reduce that 'slope,' and a lot of what they're doing in alt-fuels vehicle development is exactly that.

Questions about alt fuels remain, one of which is how automakers will pass alt-fuel costs off to the consumer. Currently, the difference in cost between a conventional gasoline-fueled California-spec car and a Federal-spec vehicle is about $200. But automakers only charge between $85 and $125 for the package.

Obviously, they amortize that cost over more vehicle lines. Can, or will those costs be spread the same way with alt-fuel vehicles?

The MVMA's Tom Hanna warns correctly that government mandates shouldn't outpace consumer acceptance, the refueling infrastructure, vehicle technology and manufacturing capabilities.

"A large number of seemingly viable fuels are seen as potential substitutes for gasoline, although each has a number of disadvantages," he notes. "It may be impossible to develop nationwide refueling infrastructures for all of them, so it's important to let free market forces—consumers and fleet owners—decide which fuels will emerge as winners." Will those in charge of making US emissions laws see it the same way?

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Circle #118 on Reader Action Card

by CHRISTOPHER A. SAWYER

CAD/CAM CONUNDRUM

In March of 1991, the Industrial Technology Institute (ITI) released a report entitled 'CAD/CAM Data Problems and Costs in the Tool and Die Industry.' If not the impetus behind the creation of the Big Three's latest consortium, the CAD/CAM R&D Partnership, it highlights a major challenge facing US automakers.

According to the study, tool and die shops receive CAD data that needs corrections 51% of the time; while in 25% of the cases, the shop has to completely recreate the dataset. ITI says the problems can be grouped into three categories: send/receive translation difficulties, designer errors and CAD/CAM system incompatibilities.

The study is quite clear on what needs to be done to correct these problems (and is available through the ITI, P.O. Box 1485, Ann Arbor, MI 48106), with the last point closest to the Big Three's desire to create a common CAD/CAM language. But that is not the consortium's only goal.

The CAD/CAM R&D Partnership's direction will be set by a nine-member panel (three from each of the Big Three). Says partnership spokesman Michael Epstein, "They will look into the feasibility of a common CAD/CAM language, but the real focus will be on what's needed from the next generation of CAD/CAM."

"What's needed now," said a source within the automotive CAD/CAM community, "is for the Big Three to create a consensus, bare-minimum dataset unique to automotive design that isn't a compilation of all their present 'alphabets.' "

This common alphabet would not prevent the companies from adding proprietary enhancements to create new 'words.' "Much of this work is already taking place under the auspices of the ISO (International Standards Organization)," says our source, "but Detroit isn't that involved. Instead, they appear to have created a parallel organization to do what they could have done through the ISO with direct participation and lobbying."

The ISO's effort is called STEP (STandards for the Exchange of Product model data), and has an American arm, PDES (Product Data Exchange using STEP), that is being coordinated by the National Institute on Standards and Technology (NIST). In total, approximately 20 countries are involved in the STEP process.

"Development of the standard is well underway," says our source, "with the goal being the exchange of all product data. It's a massive standard—the largest, most complex ever written—and has taken seven years to reach this point." The first version is expected by early 1993.

When completed, the standard will establish application protocols specific to each industry involved in the process. And these can be further divided into subsets (e.g. interior, exterior, engine, suspension, etc.), and customized by the user.

GM's EDS subsidiary is involved with the STEP process, but Ford and Chrysler are said to be sitting on the sidelines.

"This isn't in their best interest," says our source. "The more people working on the process, the more focused it is, and the faster it goes. They seem to be waiting for it to materialize before they get involved." Many automotive suppliers are involved in the STEP process.

Questioning the Big Three on their plans, focus and reasoning will have to wait until the Justice Department gives the CAD/CAM R&D Partnership its blessing. This could happen as you read this. Until this cloak of silence is lifted, detailed discussion of the partnership's plans is nothing more than speculation.

Nevertheless, it's readily apparent that data errors are a leading cause of CAD/CAM problems, and a major component of tooling lead time. What is less obvious is why the Big Three have decided to go it alone, rather than work within an existing framework. AI

COST OF CORRECTING CAD DATA PROBLEMS

Time, $	Mean Cost
Excess Labor (Man Hours)	172
Project Labor Time Waste (%)	21
Excess Tooling Time (Days)	43
Project Tooling Time Wasted (%)	27
Excess Labor Time ($)*	$8648
Materials Wasted ($)	$7148
Total Excess Cost	$19,278

*At $50/hr.
Source: ITI